MODEL 2050

NULL DETECTOR

INSTRUCTION MANUAL

FREED TRANSFORMER CO., INC.

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MP MASTER

MA34266

MODEL 2050

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APPLICATIONS:

THE TYPE 2050 NULL DETECTOR IS A SENSITIVE VISUAL NULL INDICATOR FOR USE IN A.C. BRIDGE MEASUREMENTS. ITS PRINCIPAL FEATURES ARE PORTABLE OPERATION FROM A SELF-CONTAINED BATTERY SUPPLY; RUGGED, LIGHTWEIGHT CONSTRUCTION; AND LONG MAINTENANCE-FREE LIFE.

DESCRIPTION:

THEINSTRUMENT CONSISTS OF A HIGH-GAIN TRANSISTOR AMPLIFIER WITH HIGH-IMPEDANCE INPUT AND A SENSITIVE NULL-INDICATING OUTPUT METER. RESPONSE OF THE METERING CIRCUIT IS LINEAR. IT MAY BE MADE APPROXIMATELY LOGARITHMIC BY SWITCHING THE FUNCTION SWITCH FROM "LINEAR" TO "NULL". THE INSTRUMENT MAY BE OPERATED AS A NON-SELECTIVE BROADBAND NULL INDICATOR OR AS A SELECTIVE AMPLIFIER TUNED TO EITHER 400 OR 1000 CYCLES PER SECOND BY INTERNAL RESONANT CIRCUITS.

SPECIFICATIONS:

INPUT IMPEDANCE:	1 MEGOHM RESISTIVE @ 1Kc
SENSITIVITY:	"LINEAR" POSITON-200 μv. FOR FULL-SCALE.
(AT FULL GAIN)	"NULL" POSITION 1000 μv. FOR FULL-SCALE.
SELECTIVITY:	2ND HARMONIC REJECTION GREATER THAN 20 DB.
FREQUENCY RESPONSE(UNTUNED):	40 CPS TO 20 Kc±1 DB
ON-SCALE RANGE:	20 DB IN"LINEAR" POSITION; 34 DB IN "NULL" POSITION.
POWER REQUIREMENTS:	2 MA. @ 5.3 V. INPUT (4 TYPE RM12R MERCURY CELLS)
TRANSISTORS:	5 TYPE 2N169A (GE)

OPERATION:

THE INSTRUMENT MAY BE USED UNGROUNDED; HOWEVER, CRITICAL MEASUREMENTS WILL REQUIRE THAT THE CASE BE GROUNDED FOR COMPLETE SHIELDING. THE INPUT CABLE AND PLUG SHOULD ALSO BE SHIELDED.

TO USE THE INSTRUMENT AS A NULL DETECTOR CONNECT THE BRIDGE NULL DETECTOR TERMINALS TO THE INPUT OF THE 2050. TURN THE FUNCTION SWITCH TO EITHER "NULL" OR "LINEAR" POSITION AND SET THE FILTER SWITCH TO THE OSCILLATOR FREQUENCY (400 OR 1000 CPS). ADJUST THE GAIN CONTROL TO OBTAIN AN ON-SCALE METER DEFLECTION. PROCEED TO BALANCE THE BRIDGE. BRIDGE BALANCE IS INDICATED BY A MINIMUM DEFLECTION ON THE METER.

IF HARMONICS ARE NOT DOMINANT, THE 2050 MAY BE USED AS AN UNTUNED NULL INDICATOR AT ANY FREQUENCY FROM 20∿ TO 50 KC WITH VERY GOOD SENSITIVITY. THIS OPERATION IS OBTAINED WITH THE FILTER SWITCH IN "DIRECT" POSITION.

SERVICING:

THE 2050 IS DESIGNED FOR LONG PERIODS OF MAINTENANCE-FREE OPERATION. WITH NORMAL USE, THE BATTERY LIFE (USING MALLORY RM12-R MERCURY CELLS) SHOULD BE APPROXIMATELY 1800 HOURS. IN REPLACING THESE CELLS THE FOLLOWING PRECAUTIONS ARE NECESSARY:

1. THE POLARITY OF THE CELLS IN THEIR HOLDERS MUST BE SUCH THAT THE CELL VOLTAGE WILL ADD (I.E., CONNECT (+) OF ONE CELL TO THE (-) OF THE NEXT).

2. THE POSITIVE TERMINAL OF THE BATTERY MUST CONNECT TO THE RED LEAD OF THE INSTRUMENT, AND NEGATIVE TO THE BLACK LEAD. IF THESE CONNECTIONS ARE REVERSED, THE TRANSISTORS WILL BURN OUT.

   THE TRANSISTORS ARE LONG-LIVED EXCEPT WHERE EXTREMELY HIGH AMBIENT TEMPERATURES OCCUR. IF IT BECOMES NECESSARY TO REPLACE ONE, THE NEW UNIT SHOULD BE TESTED FOR GAIN AND FOR NOISE LEVEL. IF A "BETTA TESTER IS NOT AVAILABLE, THE TRANSISTOR SHOULD BE INSERTED IN THE INSTRUMENT AND THE DEFLECTION SENSITIVITY NOTED WITH A 1KC POSITION. NEXT, REDUCE THE GAIN CONTROL TO ZERO AND SWITCH TO "DIRECT" POSITION. IF THE METER GIVES A VISIBLE READING GREATER THAN TWO DIVISIONS THE TRANSISTOR IS TOO NOISY AND SHOULD NOT BE USED.

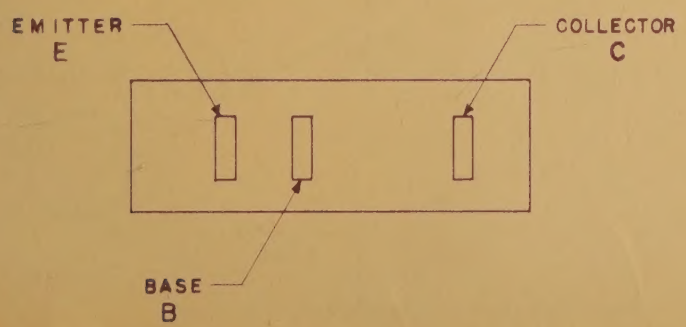
TYPICAL VOLTAGES:

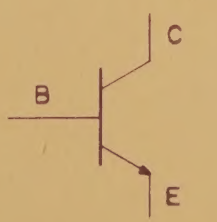
GAIN CONTROL AT ZERO. SUPPLY VOLTAGE = 5.3V.
ALL READINGS REFERRED TO COMMON (-)BUS.

VOLTAGE	T_1	T_2	T_3	T_4	T_5
V_{B-G}	0	0	.50 V.	.45 V.	.70 V.
V_{E-G}	≈.05 V.	.09 V.	.42 V.	.38 V.	.56 V.
V_{C-G}	5.3 V.	5.3 V.	1.20 V.	.70 V.	2.5 V.
CURRENT DRAWN FROM BATTERY = 2.0MA.					

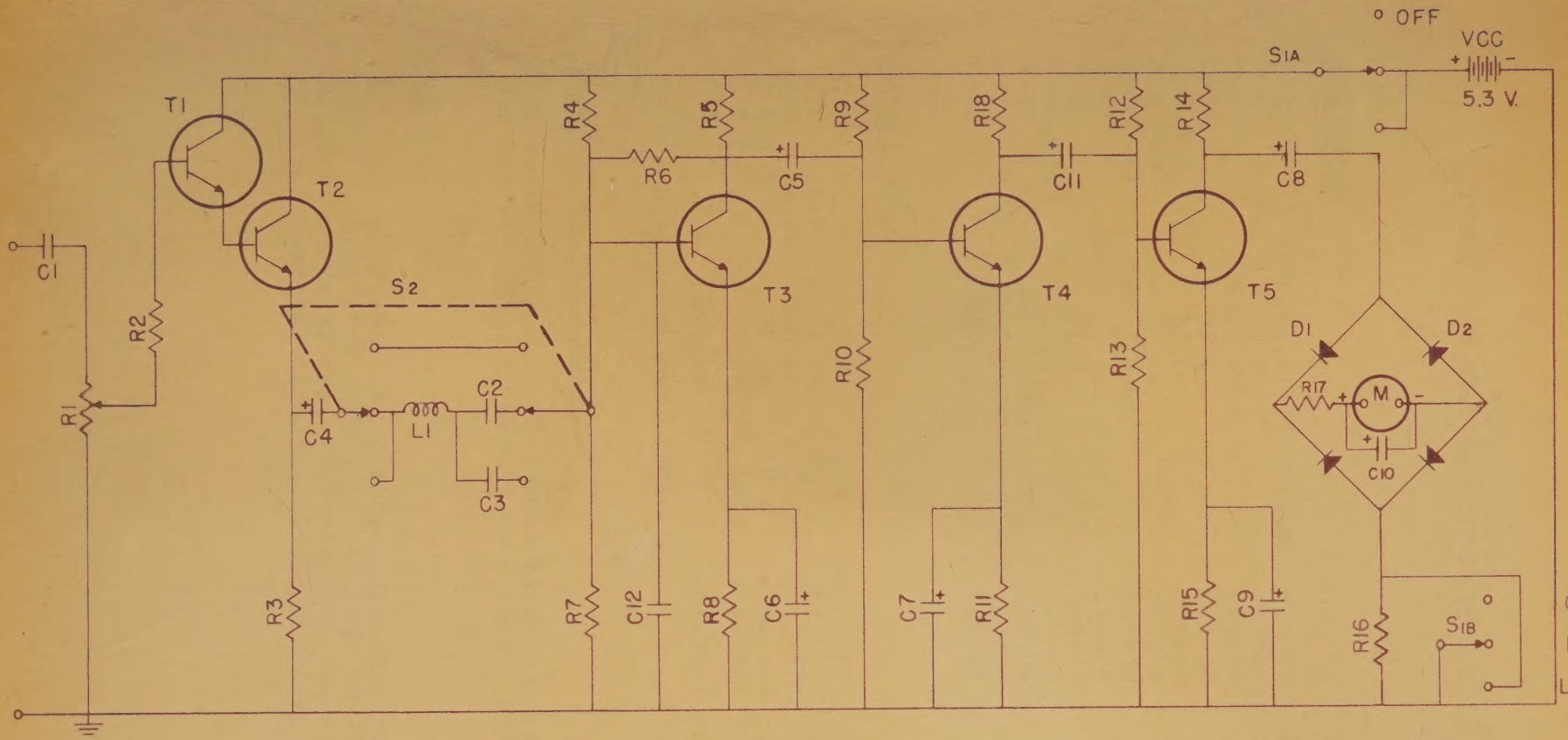
MEASURED WITH 20,000 OHM/VOLT MULTIMETER

TRANSISTOR SOCKET CONNECTIONS:





NPN SYMBOL



NOTE;

1- OBSERVE BATTERY POLARITY.

2- TO CHANGE BATTERY, REMOVE FOUR CORNER SCREWS ON REAR CASE.

TRANSISTOR NULL DETECTOR
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TRANSISTOR NULL DETECTOR PARTS LIST

RESISTORS

R-1	1 MEGOHM,	ALLEN-BRADLEY, MOLDED CARBON	POTENTIOMETER, 2W
R-2	100 K	CARBON-FILLED	1/2 W
R-3	4700 OHMS	CARBON	1/2 W
R-4	47 K	CARBON	1/2 W
R-5,R-7,R-10	10 K	CARBON	1/2 W
R-6,R-9	82 K	CARBON	1/2 W
R-8,R-14	2200 OHMS	CARBON	1/2 W
R-11	1 K	CARBON	1/2 W
R-12	39 K	CARBON	1/2 W
R-13,R-18	10 K	CARBON	1/2 W
R-15	470 OHMS	CARBON	1/2 W
R-16	1500 OHMS	CARBON	1/2 W
R-17	220 OHMS	CARBON	1/2 W

CAPACITORS

C-1	.1 MF	200 V	MINATURE PAPER	
C-2 MICA	.03 MF	300 V	(FR≅400∿)SELECT FOR EXACT RESONANCE.	
C-3 MICA	.005 MF	300 V	(FR≅100∿) ±2% FREQUENCY TOLERANCE.	
C-4,C-8	25 MF	10 V	MINATURE ELECTROLYTIC	ALUMINUM
C-5,C-11	10 MF	10 V	MINATURE ELECTROLYTIC	ALUMINUM
C-6,C-7 C-9,C-10	110 MF	3 V	MINATURE ELECTROLYTIC	ALUMINUM
C-12 MICA	1500 MMF	300 V		

TRANSISTORS AND DIODES

T-1 THROUGH T-5	GE-2N169A SELECTED, β RANGE OF 60-80
D-1 THROUGH D-4	GERMANIUM DIODES, 1N34A

MISC.

M	MICROAMMETER, 0-500MA, RUGGEDIZED.
VCC	MERCURY BATTERY, (4) MALLORY RM-12R CELLS IN SERIES.
S1,S2	WAFER SWITCH, 2P.3-POSITION, SHORTING TYPE.
L1	TOROIDAL INDUCTOR, TI-4, # F-878

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